

What is claimed is:

1. A method for visualizing cellular organelles and/or cytoskeletons, in tissue or in cell suspension, said method comprising the steps of:

- (a) obtaining a tissue sample or cell sample, said sample containing a plurality 5 of cells;
- (b) fixing said tissue sample, or cell sample;
- (c) contacting said tissue sample or cell sample with one or more crystallizing agents under conditions that permit formation of visible crystals through the reduction 10 of said crystallizing agent by the enzymes in said cellular organelles and/or cytoskeletons of said cells or tissues;
- (d) visualizing said crystals formed in said cellular organelles and/or cytoskeletons, thereby detecting the number and shapes of said cellular organelles and/or cytoskeletons.

2. The method according to claim 1, wherein said cellular organelle and/or cytoskeleton is selected from the group consisting of: mitochondrion, chromosomes, nucleosome, chromatin, nuclei, nuclear matrix, nuclear lamina, core filaments, nuclear envelope, nuclear pore complexes, nuclear membranes, centromere, centrosome, 15 centrioles, pericentriolar material, pericentrins, mitotic spindle, spindle pole bodies, contractile rings, kinetochore, telomere, plasma membranes, Golgi complexes, Golgi apparatus, endoplasmic reticulum, endosomes, peroxisomes, proteasomes, phagosomes, ribosomes, membrane skeleton, microvilli, cilia, flagella, microfilaments, 20 actin filaments, microtubules, contractile ring, and intermediate filaments.

3. The method according to claim 1, wherein the crystallizing agent is selected from the group consisting of tetrazolium salts, tetrazolium analogues and related derivatives containing tetrazolium.

4. The method according to claim 1, wherein the crystallizing agent is selected from the group consisting of p-Anisyl Blue Tetrazolium Chloride, p-Anisyl-p-Nitro Blue Tetrazolium Chloride, Thiazolyl blue (2-2'-Benzothiazolyl-5-styryl-3-(4'-phthalhydrazidyl) tetrazolium chloride), Blue tetrazolium chloride, 2-(2'-Benzothiazolyl)-5-styryl-3-(4'-phthalhydrazidyl)-tetrazolium chloride, 5-Cyano-2,3-ditolyl tetrazolium chloride), [3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyl]tetrazolium Bromide, 1-[4,5-dimethylthiazol-2-yl]-2,5-diphenyltetrazolium bromide, Distyryl nitroblue tetrazolium chloride, (1H)-tetrazole, Iodonitrotetrazolium chloride, Iodo Nitro Tetrazolium Violet Chloride, p-iodo nitrotetrazolium violet, (2-(4-iodophenyl)-3-(4-nitrophenyl)-5-phenyltetrazolium chloride, 2-(p-iodophenyl)-p-nitrophenyl-5-phenyltetrazolium chloride, m-Nitro Blue Tetrazolium Chloride, m-Nitro Neotetrazolium Chloride, 2,2-bis(2-methoxyl-4-nitro-5-sulfophenyl)-2H-tetrazolium-5-carboxanilide, 3-(4,5-dimethylthiazol-2-yl)-5-(3-carboxymethoxyphenyl)-2-(4-sulfophenyl)-2H-tetrazolium salt, tetrazolium bromide, thiazolyl blue tetrazolium bromide, 3->4,5-dimethylthiazol-2-yl!-2,5-diphenyltetrazolium bromide, Nitro Blue Monotetrazolium Chloride, p-Nitro Blue Tetrazolium Chloride, Nitro blue tetrazolium chloride, 2,2'-di-nitrophenyl-5,5'-diphenyl-3,3'-(3,3'-dimethoxy-4,4'-diphenylene)ditetrazolium chloride, Neotetrazolium chloride , 2,2',5,5'-Tetraphenyl-3,3'(p-diphenylene)-ditetrazolium chloride, Nitrotetrazolium Violet; Thiazolyl blue, tetrazolium blue chloride, 3,3'->3,3'-dimethoxy(1,1'-biphenyl)-4,4'-diyl]-bis(2,5-

diphenyl-2H-tetrazolium)dichloride, Nitroblue tetrazolium chloride, o-Tolyl Tetrazolium Red, sodium 3'-(1-[(phenylamino)-carbonyl]-3,4-tetrazolium]-bis(4-methoxy-6-nitro)benzene-sulfonic acid hydrate, p-Nitro Blue Tetrazolium Chloride, Piperonyl Tetrazolium Blue, p-Tolyl Tetrazolium Red, Thiocarbamyl nitro blue tetrazolium chloride, 2,2'-di-p-nitrophenyl-5,5'-di-p-thiocarbamylphenyl-3,3'[3,3'-dimethoxy-4,4'-biphenylene]-ditetrazolium chloride, Tetranitrcblue tetrazolium chloride, 1,3,5-triphenyltetrazolium, Tetrazolium Red, 2,3,5-triphenyltetrazolium chloride), Tetrazolium violet, Violet Tetrazolium, 2,3,5-Triphenyl-2-H-tetrazolium chloride, 2,5-diphenyl-3-[.alpha.-naphthyl]-tetrazolium chloride, 2,5-diphenyl-3-[1-naphthyl]-2H-tetrazolium chloride, Veratryl tetrazolium blue, 4-[3-(4-iodophenyl)-2-(4-nitrophenyl)-2H-5-tetrazolio]-1,3-benzene disulfonate, and 2,2-bis(2-methoxyl-4-nitro-5-sulfophenyl)-2H-tetrazolium-5-carboxanilide.

5. The method according to claim 1, wherein the concentration of crystallizing agents is in the range of between about 0.1 µg/ml to about 1.0 mg/ml.

15 6. The method of claim 1, wherein said tissue or cell sample is selected from the group consisting of normal mammalian tissue or cell, pathologic mammalian tissue or cell, neoplastic tissue or cell, vegetable, microorganism, and parasite.

7. The method of claim 6, wherein said neoplastic tissue or cell is selected from the group consisting of carcinoma, sarcoma, carcinosarcoma, leukemia, or 20 lymphoma.

8. The method according to claim 6, wherein said neoplastic tissue or cell is selected from the group consisting of acute lymphocytic leukemia, acute myelocytic leukemia, acoustic neuroma, adenocarcinoma, angiosarcoma, astrocytoma, basal cell

carcinoma, bile duct carcinoma, bladder carcinoma, bone originated tumor, bone sarcoma, brain tumor, breast cancer, bronchogenic carcinoma, carcinoma, cervical cancer, chondrosarcoma, chordoma, choriocarcinoma, chronic lymphocytic leukemia, colon carcinoma, craniopharyngioma, cystadenocarcinoma, embryonal carcinoma,
5 endotheliosarcoma, ependymoma, epithelial carcinoma, esophageal carcinoma, Ewing's tumor, fibrosarcoma, glioma, heavy chain disease, hemangioblastoma, hepatic carcinoma, hodgkin's lymphoma, leiomyosarcoma, leukemia, liposarcoma, lung carcinoma, lymphangioendotheliosarcoma, lymphangiosarcoma, medullary carcinoma, medulloblastoma, melanoma, meningioma, mesothelioma, multiple myeloma,
10 myxosarcoma, neuroblastoma, non-Hodgkin's lymphoma, pancreatic cancer, oligodendrogloma, osteogenic sarcoma, ovarian cancer, pancreatic carcinoma, papillary carcinoma, papillary adenocarcinoma, pinealoma, polycythemia vera, acute promyelocytic leukemia, prostate cancer, rectal cancer, renal cell carcinoma, retinoblastoma, rhabdomyosarcoma, sarcoma, sebaceous gland carcinoma, seminoma,
15 small cell lung carcinoma, squamous cell carcinoma, stomach carcinoma, synovioma, sweat gland carcinoma, testicular tumor, uterus carcinoma, Waldenstrom's macroglobulinemia, Wilms' tumor, and the endothelial cells thereof.

9. A kit containing one or more crystallizing agents for visualizing cellular organelles and/or cytoskeletons, in tissue or in cell suspension.

10. A kit of claim 9, wherein said cellular organelle and/or cytoskeleton is selected from the group consisting of mitochondrion, chromosomes, nucleosome, chromatin, nuclei, nuclear matrix, nuclear lamina, core filaments, nuclear envelope, nuclear pore complexes, nuclear membranes, centromere, centrosome, centrioles, pericentriolar material, pericentrins, mitotic spindle, spindle pole bodies, contractile rings, kinetochore, proteasomes, telomere, plasma membranes, Golgi complexes, Golgi apparatus, endoplasmic reticulum, endosomes, peroxisomes, phagosomes, ribosomes, membrane skeleton, microvilli, cilia, flagella, microfilaments, actin filaments, microtubules, contractile ring, and intermediate filaments.

11. A kit of claim 9, wherein the crystallizing agent is one or more tetrazolium salts.

12. A kit of claim 9, wherein said crystallizing agent is selected from the group consisting of p-Anisyl Blue Tetrazolium Chloride, p-Anisyl-p-Nitro Blue Tetrazolium Chloride, Thiazolyl blue (2-2'-Benzothiazolyl-5-styryl-3-(4'-phthalhydrazidyl) tetrazolium chloride), Blue tetrazolium chloride, 2-(2'-Benzothiazolyl)-5-styryl-3-(4'-phthalhydrazidyl)-tetrazolium chloride, 5-Cyano-2,3-ditolyl tetrazolium chloride), [3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyl]tetrazolium Bromide, 1-[4,5-dimethylthiazol-2-yl]-2,5-diphenyltetrazolium bromide, Distyryl nitroblue tetrazolium chloride, (1H)-tetrazole, Iodonitrotetrazolium chloride, Iodo Nitro Tetrazolium Violet Chloride, p-iodo nitrotetrazolium violet, (2-(4-iodophenyl)-3-(4-nitrophenyl)-5-phenyltetrazolium chloride, 2-(p-iodophenyl)-p-nitrophenyl-5-phenyltetrazolium chloride, m-Nitro Blue

Tetrazolium Chloride, m-Nitro Neotetrazolium Chloride, 2,2-bis(2-methoxyl-4-nitro-5-sulfophenyl)-2H-tetrazolium-5-carboxanilide, 3-(4,5-dimethylthiazol-2-yl)-5-(3-carboxymethoxyphenyl)-2-(4-sulfophenyl)-2H-tetrazolium salt, tetrazolium bromide, thiazolyl blue tetrazolium bromide, 3->4,5-dimethylthiazol-2-yl!-2,5-diphenyltetrazolium bromide, Nitro Blue Monotetrazolium Chloride, p-Nitro Blue Tetrazolium Chloride, Nitro blue tetrazolium chloride, 2,2'-di-nitrophenyl-5,5'-diphenyl-3,3'-(3,3'-dimethoxy-4,4'-diphenylene)ditetrazolium chloride, Neotetrazolium chloride , 2,2',5,5'-Tetraphenyl-3,3'(p-diphenylene)-ditetrazolium chloride, Nitrotetrazolium Violet; Thiazolyl blue, tetrazolium blue chloride, 3,3'->3,3'-dimethoxy(1,1'-biphenyl)-4,4'-diyl]-bis(2,5-diphenyl-2H-tetrazolium)dichloride, Nitroblue tetrazolium chloride, o-Tolyl Tetrazolium Red, sodium 3'-[1-[(phenylamino)-carbonyl]-3,4-tetrazolium]-bis(4-methoxy-6-nitro)benzene-sulfonic acid hydrate, p-Nitro Blue Tetrazolium Chloride, Piperonyl Tetrazolium Blue, p-Tolyl Tetrazolium Red, Thiocarbamyl nitro blue tetrazolium chloride, 2,2'-di-p-nitrophenyl-5,5'-di-p-thiocarbamylphenyl-3,3'[3,3'-dimethoxy-4,4'-biphenylene]-ditetrazolium chloride, Tetranitroblue tetrazolium chloride, 1,3,5-triphenyltetrazolium, Tetrazolium Red, 2,3,5-triphenyltetrazolium chloride), Tetrazolium violet, Violet Tetrazolium, 2,3,5-Triphenyl-2-H-tetrazolium chloride, 2,5-diphenyl-3-[.alpha.-naphthyl]-tetrazolium chloride, 2,5-diphenyl-3-[1-naphthyl]-2H-tetrazolium chloride, Veratryl tetrazolium blue, 4-[3-(4-iodophenyl)-2-(4-nitrophenyl)-2H-5-tetrazolio]-1,3-benzene disulfonate, and 2,2-bis(2-methoxyl-4-nitro-5-sulfophenyl)-2H-tetrazolium-5-carboxanilide.

13. A kit of claim 9, wherein said tissue or cell sample is selected from the group consisting of normal mammalian tissue or cell, pathologic mammalian tissue or cell, neoplastic tissue or cell, vegetable, microorganism, and parasite.

14. A kit of claim 9, wherein said neoplastic tissue or cell selected from the group consisting of carcinoma, sarcoma, leukemia, or lymphoma.

15. A kit of claim 9, wherein said neoplastic tissue or cell is selected from the group consisting of acute lymphocytic leukemia, acute myelocytic leukemia, acoustic neuroma, adenocarcinoma, angiosarcoma, astrocytoma, basal cell carcinoma, bile duct carcinoma, bladder carcinoma, bone originated tumor, bone sarcoma, brain tumor, breast cancer, bronchogenic carcinoma, carcinoma, cervical cancer, chondrosarcoma, chordoma, choriocarcinoma, chronic lymphocytic leukemia, colon carcinoma, craniopharyngioma, cystadenocarcinoma, embryonal carcinoma, endothelioma, ependymoma, epithelial carcinoma, esophageal carcinoma, Ewing's tumor, fibrosarcoma, glioma, heavy chain disease, hemangioblastoma, hepatic carcinoma, hodgkin's lymphoma, leiomyosarcoma, leukemia, liposarcoma, lung carcinoma, lymphangioendothelioma, lymphangiosarcoma, medullary carcinoma, medulloblastoma, melanoma, meningioma, mesothelioma, multiple myeloma, myxosarcoma, neuroblastoma, non-Hodgkin's lymphoma, pancreatic cancer, oligodendrogloma, osteogenic sarcoma, ovarian cancer, pancreatic carcinoma, papillary carcinoma, papillary adenocarcinoma, pinealoma, polycythemia vera, acute promyelocytic leukemia, prostate cancer, rectal cancer, renal cell carcinoma, retinoblastoma, rhabdomyosarcoma, sarcoma, sebaceous gland carcinoma, seminoma, small cell lung carcinoma, squamous cell carcinoma, stomach carcinoma, synovioma,

sweat gland carcinoma, testicular tumor, uterus carcinoma, Waldenstrom's macroglobulinemia, Wilms' tumor, and the endothelial cells thereof.